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DIVISION OF CHEMISTRY

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ANALYSES OF SOME MATERIALS SOLD AS  
INSECTICIDES AND FUNGICIDES

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BY  
ANDREW J. PATTEN AND D. C. KELLOGG

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EAST LANSING, MICHIGAN  
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## ANALYSES OF SOME MATERIALS SOLD AS INSECTICIDES AND FUNGICIDES.

BY

A. J. PATTEN AND D. C. KELLOGG.

The inspection and analyses of spraying materials reported herein are made under authority of an act of the Legislature of 1913 (Act 254, Public Acts of 1913). The full text of the law has been printed and copies may be obtained by addressing the Secretary of the State Board of Agriculture. Sections 1, 5, 6, and 7, which contain the more salient points of the law are, here printed in full:

SECTION 1. It shall be unlawful for any person to manufacture, sell, offer or expose for sale within the State of Michigan any insecticide, Paris green, lead arsenate, or fungicide which is adulterated or misbranded within the meaning of this act; and any person who shall violate any of the provisions of this act shall be guilty of a misdemeanor and upon conviction thereof shall be fined not to exceed two hundred dollars for the first offense, and upon conviction for each subsequent offense shall be fined not to exceed three hundred dollars, or sentenced to imprisonment in the county jail for a period not exceeding ninety days, or both in the discretion of the court.

SEC. 5. The term "insecticide" as used in this act shall include any substance or mixture of substances intended to be used for preventing, destroying, repelling or mitigating any insects which may infest vegetation, man or animals, or households, or be present in any environment whatsoever. The term "Paris green" as used in this act shall include the product sold in commerce as Paris green and chemically known as the aceto-arsenite of copper. The term "lead arsenate" as used in this act shall include the product or products sold in commerce as lead arsenate and consisting chemically of products derived from arsenic acid ( $H_3AsO_4$ ) by replacing one or more hydrogen atoms by lead. The term "fungicide" as used in this act shall include any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any and all fungi that may infest vegetation or be present in any environment whatsoever.

SEC. 6. For the purpose of this act an article shall be deemed to be adulterated, in case of Paris green:

First, If it does not contain at least fifty percentum of arsenious oxide;

Second, If it contains arsenic in water-soluble forms equivalent to more than three and one-half percentum of arsenious oxide;

Third, If any substance has been mixed and packed with it so to reduce or lower or injuriously affect its quality or strength.



In the case of lead arsenate:

First, If it contains more than fifty percentum of water;

Second, If it contains total arsenic equivalent to less than twelve and one-half percentum arsenic oxide ( $\text{As}_2\text{O}_5$ );

Third, If it contains arsenic in water-soluble forms equivalent to more than seventy-five one hundredths percentum of arsenic oxide ( $\text{As}_2\text{O}_5$ );

Fourth, If any substances have been mixed and packed with it so as to reduce, lower, or injuriously affect its quality or strength: Provided, however, That extra water may be added to lead arsenate (as described in this paragraph) if the resulting mixture is labeled lead arsenate and water, the percentage of extra water being plainly and correctly stated on the label.

In the case of insecticides or fungicides, other than Paris green and lead arsenate:

First, If its strength or purity falls below the professed standard or quality under which it is sold;

Second, If any substance has been substituted wholly or in part for the article;

Third, If any valuable constituent of the article has been wholly or in part abstracted;

Fourth, If it is intended for use on vegetation and shall contain any substance or substances which, although preventing, destroying, repelling, or mitigating insects, shall be injurious to such vegetation when used as recommended by the manufacturer.

SEC. 7. The term "misbranded" as used herein shall apply to all insecticides, Paris green, lead arsenates, or fungicides or articles which enter into the composition of insecticides or fungicides, the package or label of which shall bear any statement, design, or device regarding such article or the ingredients or substances contained therein which shall be false or misleading in any particular, and to all insecticides, Paris green, lead arsenates, or fungicides which are falsely branded as to the state, territory, or country in which they are manufactured. For the purpose of this act an article shall be deemed to be misbranded, in the case of insecticides,

Paris greens, lead arsenates and fungicides:

First, If it be an imitation or offered for sale under the name of another article;

Second, If it is labeled or branded so as to deceive or mislead the purchaser, or if the contents of the packages as originally put up shall be removed in whole or in part and other contents shall have been placed in such packages;

Third, If in package form, and the contents are stated in terms of weight and measure, they are not plainly and correctly stated on the outside of the package; in this connection it is held to be permissible to state the average net weight of the package.

In the case of insecticides (other than Paris green and lead arsenates) and fungicides:

First, If it contains arsenic in any of its combinations or in the elemental form and the total amount of arsenic present (expressed as per centum of metallic arsenic) is not stated on the label;

Second, If it contains arsenic in any of its combinations or in the elemental form and the amount of arsenic in water-soluble forms (expressed as percentum of metallic arsenic) is not stated on the label;

Third, If it does not state plainly upon the label the correct names and percentage amounts of each and every ingredient of the insecticide or fungicide having insecticidal or fungicidal properties and the total percentage of inert ingredients present.

#### COLLECTION OF SAMPLES.

Some of the samples analyzed were collected during the spring of 1914 and the remainder were collected during the spring of 1915.

No attempt has been made to secure samples of all insecticides and fungicides sold in the State as the funds allowed for this work are not sufficient to permit of a complete collection each year. In the future it is planned to center our attention on a different class of materials each year and especially upon new preparations. In this way it will be possible to cover the entire field every two or three years.

One hundred four samples of various materials have been examined and the analyses will be found in the following pages.

#### LIME-SULFUR SOLUTIONS.

The principal ingredient of lime-sulfur solution is calcium sulfide and it is possible for the compound to consist of one part of calcium to 2, 3, 4 or 5 parts of sulfur depending upon various factors. The usual proportion of calcium to sulfur in commercial lime-sulfur solutions is 1 to 4-5.

This combination is usually referred to as calcium poly-sulfide and, according to an investigation conducted by Dr. Shafer of the Entomological Department of the Michigan Experiment Station, the insecticidal and fungicidal properties of the solution are due to this compound. Other compounds (calcium thiosulfate, calcium sulfite and calcium sulfate) are also formed in small quantities but, as they probably have little or no insecticidal or fungicidal value are not included in the table.

Samples 4818, 4821, 4822, 4825, 4826, 4827, 4833, 4837, were collected in the spring of 1914, the remainder being 1915 stock.

All of the samples analyzed were found to be above the standard guaranteed by the manufacturers.



Laboratory Number.	Manufacturer.	Baumé.		Total Sulfur.		Calcium Polysulfide.
		Found.	Guaranteed.	Found.	Guaranteed.	
4818	A. B. Ansbacher, New York City.....	32.4	33	25.04	24	29.48
4819	Jas. A. Blanchard, St. Joseph, Mich.....	32.3	.....	24.94	20	29.54
4820	Jas. A. Blanchard, St. Joseph, Mich.....	30.8	.....	22.47	20	27.56
4822	Carpenter-Udell Chem. Co., Grand Rapids, Mich.....	31.8	.....	24.23	23	28.88
4821	Carpenter-Udell Chem. Co., Grand Rapids, Mich.....	31.5	.....	23.56	23	27.42
4823	Carpenter-Udell Chem. Co., Grand Rapids, Mich.....	32.0	.....	24.39	23	29.31
4824	Carpenter-Udell Chem. Co., Grand Rapids, Mich.....	32.0	.....	24.62	23	29.48
4825	Dow Chem. Co., Midland, Mich.....	33.8	33	26.51	25	31.63
4826	Dow Chem. Co., Midland, Mich.....	33.4	33	25.98	25	31.34
4827	Dow Chem. Co., Midland, Mich.....	33.9	33	26.18	25	31.25
4828	Dow Chem. Co., Midland, Mich.....	33.7	33	25.84	25	30.79
4829	Dow Chem. Co., Midland, Mich.....	33.4	33	25.79	25	30.81
4830	Dow Chem. Co., Midland, Mich.....	33.3	33	25.30	25	29.84
4831	Grasselli Chem. Co., Cleveland, Ohio.....	33.0	33	25.64	25	30.88
4832	Sanocide Spray Co., Fennville, Mich.....	32.5	32	25.17	25	29.63
4833	Sherwin-Williams Co., Chicago, Ill.....	32.5	.....	24.61	.....	29.14
4834	Sherwin-Williams Co., Chicago, Ill.....	30	.....	23.02	.....	27.33
4835	So. Haven Chem. Co., So. Haven, Mich.....	32.2	.....	24.65	23	29.82
4836	So. Haven Chem. Co., So. Haven, Mich.....	33.0	32	25.16	24	30.23
4837	Toledo Rex Spray Co., Toledo, O.....	32.7	31	25.33	24	29.43
4838	Toledo Rex Spray Co., Toledo, O.....	32.5	31	25.38	24	30.24
4839	Toledo Rex Spray Co., Toledo, O.....	32.7	31	25.20	24	29.45
4840	Van The Tool Man, Lansing, Mich.....	31.0	.....	23.80	23	28.76

## SOLUBLE SULFUR COMPOUND.

Three samples of Soluble Sulfur Compound manufactured by the Niagara Sprayer Co. were analyzed. In making this material a compound of sodium is used instead of lime. It is granular and readily soluble in water but deteriorates rapidly if exposed to the air. The package containing it should be tightly closed at all times.

Lab. No.	Manufacturer.	Total Soluble Sulfur.	Insoluble Sulfur.	Sodium Polysulfide.
4841	Niagara Sprayer Co., Middleport, N. Y.....	55.85	2.42	40.52
4842	Niagara Sprayer Co., Middleport, N. Y.....	59.35	0.44	45.16
4843	Niagara Sprayer Co., Middleport, N. Y.....	60.40	.....	.....

## LEAD ARSENATE.

The insecticide law fixes the standard for lead arsenate, making it compulsory for all samples to contain at least 12.50% arsenic oxide and not more than 0.75% arsenic oxide soluble in water nor more than 50% water.

The results of analysis show that all the samples comply with the requirements demanded by law, with one exception, in which case, the water-soluble arsenic oxide is slightly above the legal limit.

Twenty-five samples were analyzed, eight of which, were in the form of dry powder and seventeen as paste.

Samples 4853, 4858, 4844, 4850, 4861 and 4863 were collected during the spring of 1914 and the remainder during 1915.

Laboratory Number.	Manufacturer.	Water.	Arsenic Oxide.				Lead Oxide.
			Total.		Water Soluble.		
					Found.	Guar- anteed.	
			Found.	Guar- anteed.			
DRY POWDER:							
		%	%	%	%	%	%
4863	Corona Chem. Co., Milwaukee, Wis. ....	0.20	31.56	30.	0.14	0.75	65.05
4862	Corona Chem. Co., Milwaukee, Wis. ....	0.23	32.18	30.	0.23	0.75	64.16
4861	Corona Chem. Co., Milwaukee, Wis. ....	0.21	32.70	30.	0.21	0.75	64.16
4864	Corona Chem. Co., Milwaukee, Wis. ....	0.23	34.29	30.	0.17	0.75	63.89
4865	Corona Chem. Co., Milwaukee, Wis. ....	0.21	34.43	30.	0.15	0.75	64.00
4866	Grasselli Chem. Co., Cleveland, O. ....	0.41	29.69	.....	0.23	0.75	67.77
4867	Niagara Sprayer Co., Middleport, N. Y. ....	0.36	29.34	.....	0.26	.....	66.03
4868	Sherwin-Williams Co., Chicago, Ill. ....	0.36	33.55	.....	0.08	.....	63.78
PASTE:							
4844	A. B. Ansbacher, New York City. ....	39.63	18.62	15.0	0.44	0.50	39.63
4845	A. B. Ansbacher, New York City. ....	44.32	16.96	15.0	0.43	0.50	36.60
4846	A. B. Ansbacher, New York City. ....	43.96	17.72	15.0	0.32	0.50	36.72
4847	A. B. Ansbacher, New York City. ....	45.13	17.43	15.0	0.43	0.50	35.49
4848	Jas. A. Blanchard, St. Joseph, Mich. ....	47.20	14.23	12.5	0.18	0.75	36.14
4849	Jas. A. Blanchard, St. Joseph, Mich. ....	39.01	17.42	12.5	0.23	0.75	42.25
4850	Carpenter-Udell Chem. Co., Gd. Rapids, Mich. ....	44.24	12.67	12.5	0.07	0.75	40.31
4851	Carpenter-Udell Chem. Co., Gd. Rapids, Mich. ....	44.54	17.66	12.5	0.37	0.75	35.98
4852	DeVoe & Reynolds Co., New York City. ....	48.08	16.10	12.5	0.15	0.75	34.43
4853	Dow Chem. Co., Midland, Mich. ....	47.74	15.43	15.0	0.24	0.75	35.82
4854	Dow Chem. Co., Midland, Mich. ....	49.99	17.03	15.0	0.20	0.75	32.56
4855	Grasselli Chem. Co., Cleveland, O. ....	44.60	15.02	.....	0.57	.....	35.60
4856	Hemingway & Co., New York City. ....	50.39	16.14	.....	0.36	.....	31.85
4857	Merrimac Chem. Co., Boston, Mass. ....	41.73	16.38	.....	0.86	.....	39.70
4858	Sherwin-Williams Co., Chicago, Ill. ....	44.21	15.43	.....	0.17	.....	40.70
4859	Toledo Rex Spray Co., Toledo, O. ....	44.89	15.76	14.5	0.37	0.75	37.68
4860	Van The Tool Man, Lansing, Mich. ....	28.84	17.00	.....	.....	.....	51.72

## PARIS GREEN.

The prescribed standard for the composition of Paris green is not less than 50% arsenious oxide nor more than 3.50% water-soluble arsenious oxide.

Fifteen samples have been analyzed all of which were collected since January 1st, 1915. In every case the amount of arsenious oxide found was well above the amount guaranteed, though, in five samples, (4871, 4873, 4875, 4877 and 4881) the amount of water-soluble arsenious oxide was more than the amount prescribed by law.



Laboratory Number.	Manufacturer.	Arsenious oxide.				Copper Oxide.
		Total.		Soluble.		
		Found.	Guar- anteed.	Found.	Guar- anteed.	
		%	%	%	%	%
4869	A. B. Ansbacher, New York City . . . . .	57.10	50	2.11	3.50	29.53
4870	A. B. Ansbacher, New York City . . . . .	56.51	50	1.49	3.50	29.72
4871	E. J. Barry, New York City . . . . .	56.36	50	4.32	3.50	29.41
4872	Jas. A. Blanchard, St. Joseph, Mich. . . . .	58.77	50	2.60	3.50	28.52
4873	Jas. A. Blanchard, St. Joseph, Mich. . . . .	57.13	50	4.58	3.50	29.07
4874	Carpenter-Udell Chem. Co., Grand Rapids, Mich. . . . .	56.66	50	3.28	3.50	30.42
4875	Carpenter-Udell Chem. Co., Grand Rapids, Mich. . . . .	56.81	50	4.37	3.50	28.82
4876	Corona Chem. Co., Milwaukee, Wis. . . . .	56.68	50	2.79	3.50	29.47
4877	Detroit White Lead Works, Detroit, Mich. . . . .	55.32	50	3.96	3.50	29.55
4878	DeVoe and Reynolds, New York City . . . . .	57.04	56	2.91	3.00	30.12
4879	Morris Herrman & Co., New York City . . . . .	56.54	55	1.80	3.50	29.46
4880	Fred L. Lavenburg, New York City . . . . .	57.16	50	3.10	3.50	30.12
4881	Fred L. Lavenburg, New York City . . . . .	59.06	50	3.75	3.50	30.16
4882	Sherwin-Williams Co., Chicago, Ill. . . . .	56.66	50	1.59	3.50	30.40
4883	Sherwin-Williams Co., Chicago, Ill. . . . .	55.82	50	3.10	3.50	29.09

## BORDEAUX MIXTURE.

Nine samples of prepared bordeaux mixture were collected and analyzed. Two of the samples were in the form of dry powder and seven were in paste form. Samples 4888, 4889, 4891 and 4892 were collected during the spring of 1914 and the others during 1915.

One sample (4892) contained only a trace of copper and was composed almost entirely of lime. No other sample of this brand was found on the market.

Laboratory Number.	Manufacturer.	Water.	Copper.	
			Found.	Guaranteed.
		%	%	%
4884	Jas. A. Blanchard, St. Joseph, Mich.....	74.11	4.86	*4.56
4885	Carpenter-Udell Chem. Co., Grand Rapids, Mich.....	76.80	6.55	6.00
4886	Grasselli Chem. Co., Cleveland, O.....	55.47	9.52	4.50
4887	Hammond's Slug Shot Wks., Beacon, N. J.....	58.79	6.14	5.50
4888	Sherwin-Williams Co., Chicago, Ill.....	53.92	7.72	6.50
4889	Sherwin-Williams Co., Chicago, Ill.....	61.24	5.20	6.50
4890	Sherwin Williams Co., Chicago, Ill.....	52.02	8.23	6.50
4891	Sherwin-Williams Co., Chicago, Ill.....		11.60	11.00
4892	Target Brand Co., Martinsburg, W. Va.....	1.12	0.25	16.00

\*Calculated from 7% copper hydrate.

## TOBACCO PRODUCTS.

Ten samples of tobacco products were collected and analyzed, all of which, contained nicotine in amounts equal to or exceeding that guaranteed by the manufacturers.



Laboratory Number.	Manufacturer.	Nicotine.	
		Found.	Guaranteed.
		%	%
4893	Jas. A. Blanchard, St. Joseph, Mich. "Powdered Tobacco".....	0.38	.....
4894	Carpenter-Udell Chem. Co., Grand Rapids, Mich. Nicotine solution.....	10.30	10
4895	Nicotine solution.....	9.97	10
4896	Detroit Nicotine Co., Detroit, Mich. "To-Bak-Ine" liquid.....	46.38	45
4897	"To-Bak-Ine" liquid.....	45.66	45
4898	Kentucky Tobacco Products Co., Louisville, Ky. "Black Leaf 40".....	41.40	40
4900	"Nico Fume".....	41.44	40
4901	Parke Davis Co., Detroit, Mich. "Nicotine".....	12.78	10
4902	F. A. Thompson & Co., Detroit, Mich. "Rose Nicotine".....	11.85	10
4903	"Rose Nicotine".....	11.65	10

## MISCELLANEOUS MATERIALS.

4904 Bordeaux Arsenate Paste. Manufactured by A. B. Ansbacher, New York City.

	Found.	Guaranteed.
	%	%
Water.....	51.27	.....
Arsenic (Metallic).....	7.42	5.50
Arsenic (Metallic, water soluble).....	0.05	0.50
Lead Oxide.....	26.21	.....
Copper Oxide.....	3.89	3.75

4905 }  
 4906 } Bug Death. Manufactured by Danforth Chem. Co., Leominster, Mass.  
 4907 }

	Lead Oxide.		Zinc Oxide.	
	Found.	Guaranteed.	Found.	Guaranteed.
	%	%	%	%
Sample No. 4905.....	5.09	5.0	67.79	47.0
Sample No. 4906.....	7.41	5.0	60.00	47.0
Sample No. 4907.....	4.92	5.0	60.86	47.0

4908 Cut Worm and Grub Destroyer. Manufactured by Carpenter-Udell Chem. Co., Grand Rapids, Mich.

	Found.	Guaranteed.
	%	%
Arsenic (metallic).....	0.83	*0.95

\*Calculated from 1.25% As<sub>2</sub>O<sub>3</sub>.

4909 Arsite } Manufactured by Morris Herrman & Co., New York City.  
 4910 Calite }

	Water.	Arsenic (metallic)		Arsenic (sol. in water)	
		Found.	Guar- anteed.	Found.	Guar- anteed.
Sample No. 4909.....		% 31.05	% 28.8	% 31.05	% 28.8
Sample No. 4910.....	67.07	11.55	11.4	0.45	0.5

4911 Kerosene Emulsion. Manufactured by Jas. A. Blanchard Co., St. Joseph, Mich.

	Found.	Guar- anteed.
Kerosene.....	80.00	38-43

4912 Slug Shot. Manufactured by Hammond Slug Shot Wks., Fishkill, N. Y.

	Found.	Guar- anteed.
Sulfur.....	% 5.54	% 6.00
Copper Oxide.....	1.23	
Arsenic (metallic).....	0.76	

4913 Thrip Juice. Manufactured by Hammond Slug Shot Wks., Fishkill, N. Y.

	Found.	Guar- anteed.
Nicotine.....	% 2.11	% 1
Potash.....	8.04	7.80
Resin and soap.....	38.05	37.70

4914 London Purple. Manufactured by Hemingway's London Purple Co., New York City.

	Found.
Arsenic Oxide.....	% 4.84
Arsenious Oxide.....	21.43

4915 Insectonos. Manufactured by Wm. Branson; contains Pyrethrum as active ingredient, in-  
 active ingredients, charcoal and essential oils.

4916 Hellebore. Manufactured by Jas. A. Blanchard, St. Joseph, Mich. All tests indicate that  
 sample is pure hellebore.

4917 } Simplex Manufactured by H. J. Smith Co., Utica, N. Y.  
 4918 }



	Sulfur.		Arsenic (metallic)		Lead Oxide.	
	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.
Sample No. 4917.....	% 16.30	% 20	% 2.73	% 2.48	% 8.90	% 10.60
Sample No. 4918.....	25.84	20	2.48		10.60	

4919 Tuber Tonic, Dry } Manufactured by Sherwin-Williams Co., Chicago, Ill.  
 4920 Tuber Tonic, Paste }

	Sample No. 4919		Sample No. 4920	
	Found.	Guaranteed.	Found.	Guaranteed.
Water.....	%	%	%	%
Arsenic (metallic).....	18.56	17.00	54.36	8.50
Arsenic, soluble (metallic).....	1.49	6.00	10.06	2.00
Copper.....	13.46	14.00	0.71	6.30
Lead oxide.....	7.79		7.18	3.80

4921 Zenoleum Lice Killer. Manufactured by Zenner Disinfectant Co., Detroit, Mich.  
 Nicotine.....0.51 per cent.

4958 Treevax. Manufactured by Treevax Chemical Co., Hicksville, O.

Found.  
 Sulfur.....62 per cent.  
 Saltpeter.....27 per cent.  
 Iron oxide.....11 per cent.

